REMARKS

Summary of Interview with Examiner Carrillo

A telephonic interview between Examiner Bibi Sharidan Carrillo, inventor Daniel Alvarez, Jr., and Applicants' attorney Charlton Shen, was conducted on April 27, 2005, for the present application.

Independent Claims 1 and 12, and cited art references Somekh and Van Schaik were discussed during the interview.

Examiner Carrillo was concerned about the meaning of the term "pure" in Somekh. Dr. Alvarez noted that "pure oxygen gas" as used in the art does not mean a zero airborne molecular contaminant (AMC) concentration; he recited specifications from an Air Products catalog showing that "ultra high purity/zero grade oxygen" is 99.8% pure with a hydrocarbon contamination level of about 300 ppb.

Examiner Carrillo was also concerned about the term "transferred" in Claims 1 and 12, stating that the term is read upon by Somekh and Van Schaik in their teachings of removing contaminants. Drs. Alvarez and Shen pointed out that the claim recital "transferring AMC from the substrate into the purified purge gas" is not taught by the cited art since each reference teaches a reaction between the purge gas and the contaminant. Thus the contaminant is not "transferred" since its chemical disposition is transformed.

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Election/Restriction

The Office Action states that Claim 22, 20 and 24, entered in the Amendment of November 22, 2004, are withdrawn from consideration since the claims are directed to distinct inventions. The Applicants traverse the restriction requirement as being inappropriate because Claims 20, 22, and 24 do not involve a different mode of operation from examined Claims 1-19. Thus, the Claims should be examined with the remaining pending claims.

Claim 20 recites that "the purified purge gas is inert with respect to the AMC." Claim 20 depends from Claim 1, which recites that "the purified purge gas comprises oxygen." Therefore, Claims 1 and 20 do not have different modes of operation; Claim 20 utilizes a purified purge gas that comprises oxygen, like Claim 1. Claim 20 merely adds the recitation that the purified purge gas is also inert with respect to the airborne molecular contaminants (AMC), not that all purge gases (including those without oxygen) comprising an inert gas are within its scope. Therefore, Claim 20 is part of the same invention as Claims 1-19.

Similarly, Claim 24 presents the same recitation but with respect to Claim 12. Claim 12 is similar to Claim 1, except for the additional recitation regarding the oxygen concentration. Since Claims 1 and 12 were examined as part of a single invention, Claim 24 is part of that same invention as Claims 1-19 for the same reasons that Claim 20 is part of the same invention.

Claim 22 recites that "the purified purge gas comprises extra clean dry air." The Claim depends from Claim 12, which recites that "the purified purge gas comprises oxygen at a concentration between about 1% and 25% on a volume basis." Therefore, Claims 12 and 22 do not have different modes of operation; Claim 22 utilizes a purified purge gas comprises oxygen at a concentration between about 1% and 25%, like Claim 12. A purified purge gas comprising extra clean dry air is also a purified purge gas comprising oxygen at a concentration between about 1% and 25%. Thus, Claim 22 is part of the same invention as Claims 1-19.

For the aforementioned reasons, Applicants respectfully request consideration of Claims 20, 22, and 24 with the other pending claims of the application.

Amendments to Claims 1 and 12

Claims 1 and 12 are amended to place the claims in better form, consistent with the arguments presented in the Applicants' response of November 12, 2004, and the interview with the Examiner on April 27, 2005. Both claims are amended to add the phrase "the contaminated purge gas including AMC from the substrate." The amendment makes clear that the step of "producing a contaminated purge gas by transferring AMC from the substrate into the purified purge gas" results in having AMC from the substrate present in the contaminated purge gas. Support for this amendment is found in the numerous examples of the application utilizing FIG. 4, and in particular paragraph **[0044]**.

Patentability of Claim 1 and 12 over Somekh and Van Schaik

Independent Claim 1 presently stands rejected under 35 U.S.C. §102(e) as being anticipated by Somekh (U.S. Patent No. 6,427,703). Independent Claim 12 presently stands rejected under 35 U.S.C. §103(a) as being obvious in view of Somekh and Van Schaik et al. (U.S. Patent No. 6,724,460). Both Claims, however, are patentable over Somekh and Van Schaik for two independent reasons: (i) neither reference teaches "transferring AMC from the substrate into the purified purge gas, the contaminated purge gas including AMC from the substrate;" and (ii) neither reference teaches providing a purified purge gas "having an AMC concentration of less than 1 part per billion (ppb) on a volume basis."

a. Somekh and Van Schaik teach transforming an AMC, not transferring an AMC, from a substrate

Both Claims 1 and 12 recite the step of "producing a contaminated purge gas by *transferring* AMC from the substrate into the purified purge gas" (emphasis added). Somekh and Van Schaik do not provide any such teaching because the purge gases used in the cited art react with the contaminants on the surface to change their chemical disposition before the reacted contaminants are removed from the surface. Therefore, the purge gas in Somekh and Van Schaik is not "*transferring* AMC from the substrate into the purified purge gas." Rather the contaminants on the surfaces of the cited art are *transformed* into a different chemical entity that is subsequently removed.

Somekh states very clearly that the oxidizer gas transforms contaminants, such as carbon residue and hydrocarbon gas, into an oxidized carbon gas that is subsequently evacuated.

> . . . the oxidizer that is introduced into the imaging chamber from the oxidizer source acts to oxidize *any* carbon contaminants that may be present within the chamber. Thus, any carbon residue or deposits on the mask and walls of the chamber, and on any other surface within the chamber is oxidized. The oxidation process transforms *any* carbon residue that is in solid form to a gaseous form. Likewise, *any* hydrocarbon gas that is present in the imaging chamber is oxidized by the oxidizer that is supplied by the oxidizer source. The oxidization process thus creates an oxidized carbon gas within the imaging chamber. Such a gas may be produced in the form of carbon monoxide (CO) or carbon dioxide (CO_2), or other volatile carbon-oxygen compounds. The oxidized carbon gas is a volatile gas species that can be evacuated from the imaging chamber to thereby remove the oxidized carbon contaminants. (see Somekh, column 8, line 58 to column 9, line 7; emphasis added)

Van Schaik specifically recognizes that oxygen-containing species

> . . . themselves are not effective as cleaning agents, [therefore] they are used in combination with UV radiation. The UV radiation cracks the oxygen-containing species to produce atomic oxygen or other oxygen containing radicals (see Van Schaik, column 4, lines 15-19).

Van Schaik further notes in discussing the mechanism of cleaning that radicals react with contaminants on the surface (see column 7, lines 38-57). Thus, Van Schaik specifically teaches away from "transferring AMC from the substrate into the purified purge gas" because it suggests the only way for oxygen-containing species to clean a surface is creating radicals that chemically attack the contaminants.

This distinction between Somekh and Claim 1 was presented in the Applicants' amendment of November 22, 2004. In particular, it was stated that

> The method [of Claim 1] also "transfer[s] the AMC from the substrate into the purified purge gas." Somekh, in contradistinction, has a surface contaminated with carbon deposits before the oxidizer is introduced. The surface is not originally contaminated with the gas that is eventually removed. Somekh does not teach the element of Claim 1. (see Applicants' Amendment of November 22, 2004 at page 10)

As noted in item 12 of the final office action, and during the interview with the Examiner on April 27, 2005, it is suggested that Somekh reads upon the "transferring" language of Claims 1 and 12 because Somekh teaches "removing" a contaminant from a surface using a purge gas, nd such is "the whole purpose of the instant invention." The Applicants' invention, however, is defined by the language of the claims. The word "transfer" and the word "remove" are not synonyms; transferring a contaminant A from a substrate into a purge gas is not consistent with starting with contaminant A at a surface and putting a completely different chemical entity B into a purge gas. The necessity of reacting contaminants in Somekh and Van Schaik disable the references from teaching "transferring AMC from the substrate into the purified purge gas" as recited in Claims 1 and 12.

In order to further clarify the distinction over the cited art, Claims 1 and 12 are currently amended to include the phrase "the contaminated purge gas including AMC from the substrate." Somekh and Van Schaik cannot meet this recitation because the contaminated purge gases in the cited art no longer includes the AMC that was present on the surface, but an entirely different chemical entity.

In view of these remarks, Claims 1 and 12 are patentable because the cited art fails to teach the recited elements of the Claims. Since all other pending claims ultimately depend from either Claim 1 or 12, the other claims are also patentable for substantially the same reasons.

b. "Pure oxygen gas" does not mean a gas with zero contaminants to one of ordinary skill in the art

Claims 1 and 12 recite that the purified purge gas has "an AMC concentration less than about 1 part per billion (ppb) on a volume basis." The final office action, and during the interview with the Examiner, it has been repeated that Somekh teaches this element of the Claims. In particular, Somekh refers to the use of "pure oxygen gas." The Examiner contends that "pure oxygen gas" means a gas having zero AMC concentration. One of ordinary skill in the art reading Somekh, however, would not believe "pure oxygen gas" means zero AMC concentration in the gas.

As the Court of Appeals for the Federal Circuit has held, "[i]t is well settled that a prior art reference is relevant for all that it teaches *to those of ordinary skill in the art*" (see In re Fritch, 972 F.2d 1260, 1264 (Fed. Cir. 1992), emphasis added). Thus, the appropriate inquiry here is whether the phrase "pure oxygen gas" in Somekh would teach one of ordinary skill in the art that what is meant is a gas having zero AMC concentration.

As stated by Dr. Daniel Alvarez, Jr. during the interview with the Examiner, and as set forth in an appended declaration under 37 C.F.R. §1.132 (unexecuted, executed copy will be submitted shortly), one of ordinary skill in the art would not interpret the phrase "pure oxygen gas" in Somekh to mean a gas having zero AMC concentration. The declaration sets forth various exhibits from industrial providers of "pure" gases for the chemical and electronic industries. Each exhibit shows that "pure" oxygen gases, in fact, contain some level of contaminants. Indeed, of the exhibits provided, even the oxygen gas with the leanest amount of contaminants has as much as 100 parts per billion. Thus, the phrase "pure oxygen gas" is not recognized as meaning an oxygen gas having zero AMC concentration.

In light of the remarks presented herein, Claims 1 and 12 are patentable over the cited art since neither reference teaches "an AMC concentration less than about 1 part per billion (ppb) on a volume basis."

If the Examiner insists that "pure oxygen gas" means an oxygen gas having zero AMC concentration, Applicants respectfully request the entry of an affidavit by the Examiner into the record. Such an affidavit would clarify the Examiner's basis for interpreting the phrase "pure oxygen gas" consistent with the understanding of one of ordinary skill in the art. The Examiner's current interpretation appears to be drawn from personal knowledge, as no evidentiary support has been presented on the record. Thus, in accordance with 37 C.F.R. §1.104(d)(2), the Examiner is requested to set forth the data supporting such an interpretation, in light of the Applicants arguments herein.

Double Patenting

The final Office Action maintains that Claims 1-5, 8-11, 12-15, 18-19, 21, and 23 of the present application are provisionally rejected under the judicially created doctrine of obviousness-type double patenting in light of particular claims of copending U.S. Application No. 10/683,904 and either Somekh or Van Schaik. The claims are not obvious, however, because the suggested combinations do not teach or suggest the pending claims of the present application.

As discussed above, Somekh and Van Schaik provide no teaching or suggestion that a purge gas comprising oxygen and having an AMC concentration less than 1 ppb can be used to produce a contaminated purge gas by *transferring* AMC from the substrate into the purified purge gas, the contaminated purge gas including AMC from the substrate. Thus, combining either reference with any of the claims of U.S. Application No. 10/683,904 does not suggest that a purge gas comprising oxygen may be used by the methods recited in the pending claims. Although the claims of U.S. Application No. 10/683,904 include the step of "producing a contaminated purge gas by transferring AMC from the substrate into the purified purge gas," the purified purge gas comprises water at a concentration of at least about 100 ppm. No suggestion or teaching exists pointing to the use of a purge gas comprising oxygen that meets all the recitals of Claims 1 and 12. The claims of U.S. Application No. 10/683,904 combined with either

Somekh or Van Schaik in no way suggest the full scope of Claim 1 or 12 of the present application.

The final Office Action maintains that the claims of the pending application are not patentably distinct from the claims of U.S. Application No. 10/683,904 because the claims are directed to the removal of airborne contaminants from a surface and purifying a purge gas. The patentability of a claim, however, is not negated because some elements of the claim are taught by the copending application. Indeed, the *entire* claim must be obvious in light of the cited art to render a claim unpatentable. Since the elements of "transferring AMC from the substrate into the purified purge gas, the contaminated purge gas including AMC from the substrate," where the purified purge gas comprises oxygen, are not taught by the citations, the pending claims are not obvious. The pending claims are patentably distinct from the claims of U.S. Application No. 10/683,904.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By____________________
Charlton Shen
Registration No. 54,442
Telephone: (978) 341-0036
Facsimile: (978) 341-0136

Concord, MA 01742-9133
Dated: 16 May 2005

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Jeffrey J. Spiegelman, Daniel Alvarez, Jr., Allan Tram and Russell J. Holmes

Application No.: 10/683,903 Group: 1746

Filed: October 10, 2003 Examiner: Carrillo, Bibi Sharidan

Confirmation No.: 3062

For: METHOD FOR THE REMOVAL OF AIRBORNE MOLECULAR CONTAMINANTS USING OXYGEN GAS MIXTURES

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5-16-05 Pamela Sarno
Date Signature

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Typed or printed name of person signing certificate

DECLARATION OF DANIEL ALVAREZ JR., Ph.D., UNDER 37 C.F.R. §1.132

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Alexandria, VA 22213-1450

Sir:

The undersigned, Dr. Daniel Alvarez Jr., a United States citizen, declares as follows:

1. I am a co-inventor of the above-captioned patent application.

2. As discussed in the Office Action mailed on February 16, 2005, and reiterated by the Examiner during a telephonic interview on April 27, 2005, the use of the phrase "pure

oxygen gas" in Somekh (U.S. Patent No. 6,427,703) is interpreted by the Examiner as an oxygen gas having a contaminant concentration of zero (i.e., not having a single atom or molecule of contamination).

3. The term "pure oxygen gas," however, does not refer to a gas having a contaminant concentration of zero. In fact, the phrase "pure oxygen gas" would not suggest a gas having zero contaminants to one of ordinary skill in the art.

4. Exhibit A presents a page of an Air Products Catalog from 1998, which documents various high purity grades of oxygen gas that were commercially available. Air Products is a leader in the supply of "pure" gases to the chemical and semiconductor industry. The product "ultra high purity/zero" oxygen is, in fact, rated as 99.8% pure, having a total hydrocarbon content of as much as 500 parts per billion. The product "ultrapure carrier" oxygen is, in fact, rated as being 99.996% pure, having a total hydrocarbon content of as much as 500 parts per billion. The product "research" oxygen is 99.998% pure, having a hydrocarbon content of as much as 200 parts per billion.

5. Exhibit B presents a print out of a web page from the Air Products website describing their offerings of "Pure Gases." In particular, the page states that "[t]his section provides details of the pure gaseous and liquids chemicals, *and their respective purities* . . ." (emphasis added).

6. Exhibit C presents the specific offerings of "Ultra High Purity Gases" from the Air Products website listed above. In particular, three entries are presented for oxygen specified as having 1,000 parts per billion total hydrocarbon content ("Premier"), 500 parts per billion total hydrocarbon content ("UltraPure"), and 100 parts per billion total hydrocarbon content ("UltraPure Plus"). As stated on the first page, "[Experis™ ultra high purity gases] contain the lowest levels of critical impurities available on the market."

7. Exhibit D presents a print out of a web page from the Scott Specialty Gases website entitled "Pure Gas Products." Under the link to the corresponding oxygen product is a

webpage presenting two grades of oxygen: one has a total hydrocarbon content as high as 1,000 parts per billion and the other has a total hydrocarbon content as high as 100 parts per billion.

8. Exhibit E presents a print out of a web page from the Wesco Gas Products website. In particular, the link to "Pure Gas" is presented. The gases are from Wesco's vendor BOC gases, the world's largest producer of industrial gases. The table under "Pure Gas Information & Tables" presents the various gas purities associated with each gas grade. Indeed, every listed grade in the table has at least 1,000 part per billion of total impurities. No pure gas listing has zero contaminants.

9. These exhibits demonstrate that the phrase "pure oxygen gas" does not mean that the oxygen gas contains zero contaminants.

10. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date	Daniel Alvarez, Jr., Ph.D.

Exhibit A: Excerpt from a 1998 Air Products catalog entry.

Exhibit B: Webpage from Air Products website (viewed 10 May 2005) – www.airproducts.com/specgases/pure/20001.htm

Exhibit C: Product sheet from Air Products website providing the purity limits of various gases including oxygen (viewed 10 May 2005) - www.airproducts.com/specgases/pure/20001.htm

Exhibit D: Webpages from Scott Speciality Gases website (viewed 10 May 2005) – www.scottsemicon.com/pures/pindex.html

Exhibit E: Webpage from Westco Gas Products website (viewed 10 May 2005) – www.wesco-gas.com/products/gas/puregas.html

AIR PRODUCTS

Oxygen (O_2)

A colorless, odorless, oxidizing compressed gas at high pressure.

Toxicity: Nontoxic; exposure to high concentrations adversely affects pulmonary and central nervous systems.
Fire Potential: Strong oxidizer; supports and vigorously accelerates combustion. Avoid contact with oil, grease, or other combustible materials.
Compatible Materials: Noncorrosive; structural materials must be suitable for oxygen service.
Molecular Weight: 32.00
Specific Volume at 70°F and 1 atm: 12.08 ft³/lb
DOT Hazard Class: Nonflammable Gas (2.2)
DOT Label: Oxidizer and Nonflammable Gas
DOT ID No.: UN 1072
CAS No.: 7782-44-7

Cylinder Size	Cylinder Dimensions (in.)	Cylinder Pressure at 70°F (psig)
A	9 x 55	2,640
C	7 x 33	2,215
D	4 x 17	2,215
4X(Al)-100	4 x 10	850

	Ordering Information				Recommended Equipment		
Specifications (molar ppm)	Cylinder Size	Contents ft³ (m³)	Standard Valve Outlet (CGA)	Product Number	Description/ Product Number	Delivery Pressure Range (psig)	Page Number
RESEARCH **99.998%** Guaranteed Spec. Ar < 5 CO_2 < 0.5 CO < 1 Kr < 2 H_2O < 0.5 N_2 < 5 THC < 0.2	A D 4X(Al)-100	339 (9.60) 15 (.425) 3.53 (.10)	540 540 540	A01-A-42016 A05-X-42016 A34-F-42016	**GASGUARD®** 3- or 4-valve Gas Panel with pigtail **Single-Stage Regulators** E11-215D0X	 0-100	217 177
	Individual Certificate of Analysis is included with each cylinder. F.O.B. Hometown, PA; Chicago, IL; and Research Triangle Park, NC						
ULTRAPURE CARRIER **99.996%** Guaranteed Spec. N_2 < 15 THC < 0.5 H_2O < 1	A C	339 (9.60) 90 (2.55)	540 540	A01-T-42014 A03-L-42014	**Single-Stage Regulators** E11-215D0X	0-100	177
	Batch Certificate of Analysis available upon request. Recommended for TOC analyzers. F.O.B. Hometown, PA; Chicago, IL; Mountain View, CA; and Research Triangle Park, NC						
UHP/ZERO **99.8%** Guaranteed Spec. THC < 0.5 H_2O < 3.5	A C	339 (9.60) 90 (2.55)	540 540	A01-4-42013 A03-W-42013	**Single-Stage Regulators** E11-215D0X	0-100	177
	Batch Certificate of Analysis available upon request. F.O.B. Hometown, PA; Chicago, IL; Mountain View, CA; and Research Triangle Park, NC						

Ex. A

PURE GASES | GAS MIXTURES

EQUIPMENT | SAFETY | ORDERING

Please note: The specifications found in the catalog are specific to the U.K. and Ireland.

Pure Gases

- Acetylene C_2H_2
- Air Synthetic 21% O_2+79% N_2
- Ammonia NH_3
- Argon Ar
- Arsine AsH_3
- Boron Trichloride BCl_3
- Boron Trifluoride BF_3
- Butane (n-) n-C_4H_{10}
- Butene-1 C_4H_8
- Carbon Dioxide CO_2
- Carbon Monoxide CO
- Chlorine Cl_2
- Deuterium D_2
- Dichlorosilane SiH_2Cl_2
- Disilane Si_2H_6
- Ethane C_2H_6
- Ethylene C_2H_4
- Ethylene Oxide C_2H_4O
- Fluorine F_2
- Halocarbon 14 CF_4
- Halocarbon 22 $CHClF_2$
- Halocarbon 23 CHF_3
- Halocarbon 116 C_2F_6

Pure Gases

This section provides details of the pure gaseous and liquids chemicals, their respective purities and cylinder sizes most commonly supplied by Air Products in Europe. However, this is only a sample of the full range of products, purities and cylinder sizes that Air Products is able to supply. We shall be pleased to receive enquiries for products or purities not shown in this section.

To see the details on one of our products, click on the product name on your left side.

Would you like more information or to leave us a message?

YES

Air Products Home - Special Gases Home - Feedback - Help - Search

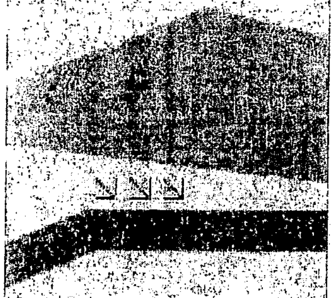
Ex. B

AIR PRODUCTS

EXPERIS™
Ultra High Purity Gases

- Purity
- Accuracy
- Stability

Experis ultra high purity gases have been specifically designed for the analytical user. They contain the lowest levels of critical impurities available on the market. When combined with our patented BIP® technology you will enjoy product consistency, reliable analytical results and trouble free operation.
Air Products understands the critical importance of UHP gases and the impact of impurities on your results. Our range of Experis UHP gases will meet your most stringent requirements.

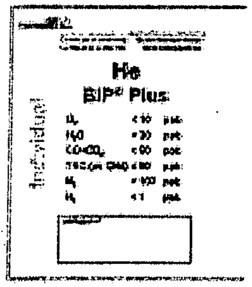


Experis Gases

Whatever your application, be it chemical analysis or process control, our Experis UHP range offers you the optimum gas solution. Acetylene, air, argon, carbon dioxide, helium, hydrogen, nitrogen, and oxygen are available with a range of purity levels. They can be supplied in a cylinder size to suit your specific requirements, from small 0.4 litre cylinders to packs of 18 large cylinders.

Certified Purity

It is not just the ultra high purity of the gas that offers peace of mind, but also the certainty of knowing the maximum level of specific impurities contained in the gas. Understanding which impurities, and at what level, interfere with your specific analysis, enables us to provide you with a range of gases and grades which enable you to achieve the most accurate results. Our Experis specialists can assist you in selecting the optimum gas for your application. All Experis UHP gases come with certified maximum impurity levels and, of course, our quality assurance systems are ISO 9000 certified.

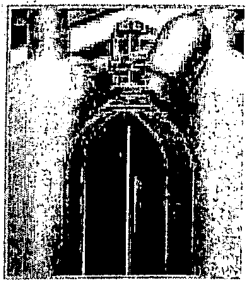


He

BIP® Plus

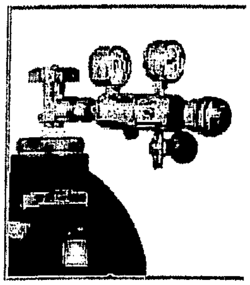
BIP cylinders

Our unique BIP cylinders, using a patented method for removing impurities as the gas is withdrawn from the cylinder, offer the very highest purity levels for the most demanding laboratory applications. Every BIP cylinder contains less than 10 ppb of oxygen and less than 20 ppb of water. BIP nitrogen, helium and argon are 300 times purer compared with the equivalent industrial product. BIP technology gives you the ultimate zero gas; this means longer chromatographic column life, ultra low dew points and zero process contamination.



Gas Equipment

The use of specially designed and engineered gas control equipment ensures that gas reaches the point of use not only at the required purity, but also at the required pressure and flow rate. At Air Products, we use our expertise in ultra high purity gases and their applications to offer you a comprehensive range of UHP gas control equipment, including regulators and manifolds. All equipment is designed to the highest standards and is extensively leak-tested. We also offer an extensive design, build and install service giving you complete peace of mind whatever your application.



Ex. C

Ultra High Purity Gases : standard specifications

Other sizes, purities or analyses available on request. Please contact Air Products

*Equivalent watercapacity in litres, details below

[illegible]	[illegible]							[illegible]	Cylinder size*									Certificate of conformity
									Cylinders					Banks				
	PH_3	H_2S							30	40					12x50			C_2H_2
Premier	10	10						2.6	✓	✓					✓			Batch
	H_2O	O_2	THC[1]	$CO+CO_2$	Ar	$NO_X/NH_3/SO_2/H_2S$			10	47				11x47				Air
Zero (21% O_2 +/-1%)	3	-	0.2	1	-	-		4.8	✓	✓				✓				Batch
Zero Plus (20.8% O_2 +/-0.2%)	0.5	-	0.05	0.1	0.01	ND[3]		6.0	✓	✓								Individual
	H_2O	O_2	THC[1]	$CO+CO_2$	N_2				0.4	2	9	10	47	11x47	12x50			Ar
Premier	2	2	0.1	-	4			5.2			✓	✓	✓	✓				Batch
BIP®	0.02	0.01	0.1	0.1	1			5.7					✓		✓			Batch
BIP® Plus	0.02	0.01	0.05	0.05	0.3			6.6					✓					Individual
5.5	1	1	0.1	0.5	2			5.5		✓								Batch
6.0	0.5	0.1	0.05	0.05	0.3			6.0	✓			✓						Individual
	H_2O	O_2	THC[1]	$CO+CO_2$	H_2	CFC[2]				2	9	10	47	11x47	12x50			N_2
Premier	2	3	0.5	-	-	-		5.2		✓	✓		✓	✓				Batch
BIP®	0.02	0.01	0.1	0.5	1	-		5.7					✓		✓			Batch
BIP® ECD	0.02	0.01	0.1	0.5	1	0.001		5.7					✓					Batch
BIP® Plus	0.02	0.01	0.05	0.05	0.05	-		6.8					✓					Individual
5.5	1	2	0.1	0.5	1	-		5.5				✓						Batch
6.0	0.5	0.4	0.05	0.05	0.05	-		6.0				✓						Individual
	H_2O	O_2	THC[1]	CO	N_2				0.4	2	9	10	47	11x47				CO_2
Premier	7	10	5	2	25			4.5	✓		✓		✓	✓				Batch
Premier Liquid	7	10	5	2	25			4.5			✓		✓					Batch
UltraPure	2	0.5	0.1	0.5	2			5.5					✓					Individual
UltraPure Liquid	2	0.5	0.1	0.5	2			5.5					✓					Individual
	H_2O	O_2	THC[1]	$CO+CO_2$	N_2	H_2	CFC[2]		0.4	2	9	10	47	11x47	12x50	17x50	18x50	He
Premier	2	1	0.5	-	5	-	-	5.2	✓			✓	✓	✓				Batch
BIP®	0.02	0.01	0.1	0.5	1	-	-	5.7					✓		✓			Batch
BIP® ECD	0.02	0.01	0.1	0.5	1	-	0.001	5.7					✓					Batch
BIP® Plus	0.02	0.01	0.05	0.05	0.1	0.1	-	6.7					✓		✓			Individual
5.5	1	0.5	0.1	0.5	1	-	-	5.5				✓		✓			✓	Batch
6.0	0.5	0.1	0.1	0.1	0.1	-	-	6.0				✓				✓		Individual
	H_2O	O_2	THC[1]	$CO+CO_2$	N_2				0.4			10	47	11x47	17x50			H_2
Premier	2	1	0.2	1	5			5.0					✓					Batch
Premier Plus	2	1	0.1	0.5	5			5.2	✓			✓	✓	✓	✓			Batch
UltraPure	1	0.5	0.1	0.5	2			5.5					✓					Batch
UltraPure Plus	0.5	0.1	0.05	0.05	0.2			6.0				✓	✓	✓				Individual
	H_2O	O_2	THC[1]	$CO+CO_2$	N_2	H_2	Ar		0.4			10	47	11x47				O_2
Premier	5	-	1	1	40	1	-	4.5					✓					Batch
UltraPure	1	-	0.5	0.5	5	0.5	-	5.2	✓			✓	✓	✓				Batch
UltraPure Plus	0.5	-	0.1	0.1	1	0.1	0.1	5.8				✓	✓					Individual

Description of the cylinder sizes

Watercapacity	Air Products code	Description	Approximate contents[4]	Old code for reference only
0.4 L	X0.4S	Lecture bottle Steel	0.1 m³	LB
2 L	X2S	Steel cylinder	0.4 m³	B2
9 L	X9S/X9A	Steel cylinder	1 m³	F/FA
10 L	X10S	Steel cylinder	2 m³	PT10
30 L	X30S	Steel cylinder	5 m³	MD30
40 L	X40S	Steel cylinder	7 m³	Y41
47 L	X47S	Steel cylinder	10 m³	K/L
11x47 L	11X47S	11 cyl. bank	110 m³	PL11
12x50 L	12X50S	12 cyl. bank	120 m³	PB50
17x50 L	17X50S	17 cyl. bank	170 m³	P50W
18x50 L	18X50S	18 cyl. bank	180 m³	VB50

Remarks :

- Other sizes, qualities and analyses available on request
- Usual filling pressure : 200 bar.g
- The above data can be subject to changes
- [1]. THC = as CH_4
  [2]. CFC = halocarbons
  [3]. ND = non detectable
  [4]. Except for CO_2

For more information, please refer to "FAQ about chromatographic gases" or contact your Experis™ specialist !

United Kingdom
Air Products PLC
2 Millennium Gate
Westmere Drive - Crewe CW1 6AP
Tel. : 0845 777 8800 - Fax : 01 270 61 4170
E-mail : getgas@apci.com

Ireland
Air Products Ireland Ltd.
52 Broomhill Road - Tallaght
Dublin 24
Tel. : (01) 463 4242 - Fax : (01) 463 4292
E-mail : ieinfo@apci.com

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Scott Specialty Gases
SEMICONDUCTOR & ELECTRONIC APPLICATIONS

Pure Gases, Mixtures & Delivery Equipment

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Pure Gases | Gas Mixtures | Equipment | Tech Data

Pure Gas Products

The standard grades of pure gases and liquids listed here have been chosen to meet the varied requirements of lab and process engineers throughout the semiconductor industry. For example, Scott offers an exceptionally high grade of argon to reduce impurities in sputtering depositions. Scott Electronic Grade pure gases and liquids meet or exceed SMI specifications. Scott Sputtering, U.L.S.I., V.L.S.I., Etchant, Sigma 3 and Nitride grades are of higher purity and exceed SEMI specifications where they exist. In addition, Scott extensive purification capabilities and processes enable us to provide custom grades of pure gases and liquids for the fab engineer with specialized requirements. Further, we are a one-stop source for supplying your new and unusual materials needs. Contact your Scott Representative for more information about custom pure gases and liquid products.

Pure gases and liquids are listed alphabetically. Each product includes useful technical information, available cylinder sizes with pressures and contents, along with appropriate safety information.

Recommendations for regulators, purge panels and gas cabinets are also provided for safe handling of the product. Many of our listings include a product shelf life period that has been thoroughly tested and documented.

A number of products such as Halocarbon 14, helium and nitrogen are sold in a gaseous state. Others such as boron trichloride, hydrogen chloride and nitrous oxide are sold as liquids. For liquid-state products, vapor pressure at 70°F and boiling points at one atmosphere are included in product listings. Complete vapor pressure curves are available upon request. Each gas listing includes a specification table detailing total purity as well as guaranteed maximum concentrations of critical impurities. We have made every effort, based on input from our customers, to establish meaningful specifications for both purity assays and impurity specifications. To validate the impurity levels in the products we deliver, Scott has prepared sets of master trace gas standards for pure gas analysis.

☎ Order toll-free: **866-704-6513** or Contact Us

- Ammonia / NH_3
- Argon / Ar
- Arsine / AsH_3
- Boron Trichloride / BCl_3
- Boron Trifluoride / BF_3
- Carbon Dioxide / CO_2 *
- Carbon Monoxide / CO
- Chlorine / Cl_2
- Diborane / B_2H_6 *
- Dichlorosilane / SiH_2Cl_2
- Germane / GeH_4
- Halocarbon 14 (Tetrafluoromethane) / CF_4
- Halocarbon 23 (Trifluoromethane) / CHF_3
- Halocarbon 32 (Difluoromethane)- Zyron 32 / CH_2F_2 *
- Halocarbon 41 (Methyl Fluoride) / CH_3F *
- Halocarbon 116 (Hexafluoroethane) / C_2F_6
- Halocarbon 125 (Pentafluoroethane)- Zyron 125 / C_2HF_5
- Halocarbon 134a (1,1,1,2-Tetrafluoroethane)- Zyron 134a / $C_2H_2F_4$ *
- Halocarbon 218 (Perfluoropropane) / C_3F_8 *
-
- Helium / He
- Hydrogen / H_2
- Hydrogen Bromide / HBr *
- Hydrogen Chloride / HCl
- Methane / CH_4
- Neon / Ne
- Nitric Oxide / NO *
- Nitrogen / N_2
- Nitrogen Trifluoride / NF_3
- Nitrous Oxide / N_2O *
- Oxygen / O_2
- Phosphine / PH_3
- Silane / SiH_4
- Silicon Tetrachloride / $SiCl_4$
- Silicon Tetrafluoride / SiF_4 *
- Sulfur Hexafluoride / SF_6 *
- Trichlorosilane / $SiHCl_3$
- Xenon / Xe

Ex. D

Halocarbon c-318 (Octafluorocyclobutane) / C_4F_8

* MSDS Sheets available

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Scott Specialty Gases
SEMICONDUCTOR & ELECTRONIC APPLICATIONS

Pure Gases, Mixtures & Delivery Equipment

Oxygen O_2

DESCRIPTION: Oxygen (O_2) is a colorless, odorless, nontoxic, highly oxidizing gas which sustains life and vigorously supports combustion. Oxygen is normally compressed and shipped at high pressures.

APPLICATION: Oxygen in high-purity is used in a broad range of oxidation, plasma etching and chemical vapor deposition (CVD) processes.

Order **Oxygen** toll-free: **866-704-6513** or Contact Us

OXYGEN		
GRADE	**MOS**	**VLSI**
Critical Assay	99.97%	99.994%
Meets Semi Specification	SEMI C3.16-95	SEMIC3.23-95
Nitrogen	< 100 ppm	< 15 ppm
Total Hydrocarbons (as CH4)	< 1 ppm	< 0.1 ppm
Carbon Dioxide	< 2 ppm (+CO)	< 0.5 ppm
Water	< 2 ppm	< 1 ppm
Carbon Monoxide	-	< 0.5 ppm
Nitrous Oxide	< 2 ppm	< 1 ppm
Argon	< 50 ppm	< 15 ppm
Rare Gases	-	< 10 ppm
Valve Material	Brass	Brass/Monel®
Valve Design	Diaphragm	Diaphragm
CGA/DISS Connection	540	540

Molecular Weight: 32.0
Specific Volume: 12.1 cf/lb @ NTP
Boiling Point: -297.4°F @ 1 atm
CAS No.: 7782-44-7
Hazards: High Pressure and Oxidizer

Safety Data: Supports Life
Physical Properties Data:
Critical Temperature: -181.4°F
Critical Pressure: 731.4psia

OXYGEN

Cylinder Data/Size	K	A	B	C
Internal Volume (liters):	50	44	17	7
Contents (cubic feet):	308	249	90	36
Pressure @ 70°F (psig):	2,400	2,200	2,000	2,000

DOT Label: Green, Nonflammable Gas; Yellow, Oxidizer
UN Number: UN 1072
DOT Class: 2.2
Cylinder: Steel alloy

Recommended Regulators: Two-Stage, Brass - Model 218 series
Single-Stage, Brass - Model 2300 series

Shelf Life: 3 years

Ex. D

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Gases Information | Bulk Gas | Mixed Gas | Pure Gas | Specialty Gas | Gas Safety

PURE GAS
- > Top
- > Acetylene
- > Air
- > Ammonia
- > Argon
- > n-Butane
- > Carbon Dioxide
- > Carbon Monoxide
- > Chlorine
- > Deuterium
- > Ethane
- > Ethylene
- > Helium
- > Hydrogen
- > Hydrogen Chloride
- > Krypton
- > Methane
- > Methyl Chloride
- > Neon
- > Nitrogen
- > Nitrous Oxide
- > Oxygen
- > Propane
- > Propylene
- > Sulfur Dioxide
- > Sulfur Hexaflour
- > Xenon

PURE GAS INFORMATION & TABLES

Assurance of Gas Purity

Our primary vendor BOC Gases is the worlds largest producer of industrial gases. With more than 75 years experience, they supply us with the highest purity of product attainable today. The following pure gases are classified by Grade, this eliminates any question about purity levels of the gases sold to our customers.

Classification	Minimum Purity	Total Impurites
Grade 6	99.9999 %	1 ppm
Grade 5.5	99.9995 %	5 ppm
Grade 5	99.999 %	10 ppm
Grade 4.5	99.995 %	50 ppm
Grade 4	99.99 %	100 ppm
Grade 3.5	99.95 %	500 ppm
Grade 3	99.9 %	1,000 ppm

Equipment Recommendations

Each pure gas listing includes equipment recommendations for regulators. We strongly urge that you select this equipment, it has been chosen because it meets the requirements of the gas to assure you receive reliable delivery of product from the cylinder.

Purity Specifications

For more detailed information regarding the break down of purity specifications, contact one of our SALES ASSOCIATES via Email in order to receive a Gas Vendor Catalog, or call us today at **(650) 368-2821.**

Visit our VENDORS page for more information on BOC Gases,
Matheson Gas Products and Air Products .

For CATALOGS > E-Mail > CATALOGS@wesco-gas.com

PURE GASES

Acetylene > C2H2 .

Grade	Purity	Cyl. Size US	Contents @ NTP cf	Pressure (psig) @70 F	Valve
Atomic Absorption Grade 2.6	99.6 %	5	330	250+	CGA 510
		4	100	250+	
		3	60	250+	

Air .

Grade	Cyl. Size US***	Contents @ NTP cf	Pressure (psig) @70 F	Valve
Zero Grade 0.1	300	310	2640	

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